If there is any serious concern that cellular operators might attempt to "warehouse" PCS spectrum for which they are licensed, the appropriate regulatory approach would be to enforce the stringent "fill-in" requirements described above. The possible loss of all or a portion of a valuable PCS license is a powerful incentive, which we believe the Commission should adopt in any event to deter speculation.

(5) Common Carrier Regulatory Classification should be adopted for PCS.

Our recommendation that PCS be regulated as a common carrier service is based upon the Commission's own analysis of the "universal" scope of projected domestic and international demand for portable PCS communications capacity. Projected uses for PCS include supplementing, and in some cases replacing, backbone components of common carrier local exchange operations such as for wireless local loop functions. Additional configurations of PCS include the use of microcell technologies connected to CATV coaxial or fiber optic capacity to compete with common carrier local exchange operations for local area communications requirements. Still other configurations will permit establishment of wireless versions of public coin-phone operations and portable interconnected switched voice services. The estimates of industry analysts that 60 million or more Americans (over and above the current total of all cellular, paging, and dispatch radio subscribers) will subscribe to PCS services within the next ten

years, also confirms the unprecedented scope of the market for PCS-based services.[9]

As a broad-based service offering to the public, it is essential that basic consumer rights be protected in a way which is not required for private land mobile radio services. The most significant applications of PCS technology are functionally indistinguishable from existing common carrier services for which there is a long history of federal, state and local regulatory oversight to protect consumer interests. We strongly support continued application of all of the basic consumer protections which are assured under Sections 201 through 208 of the Communications Act and the special protections for the hearing and speech disabled in Section 225 of the Communications Act.

To the extent that PCS technologies are used to provide "exchange" services, it is also incumbent upon the Commission to recognize and support the unique role of state and local regulatory oversight with respect to exchange operations. Most of the use of microcell-based PCS systems is likely to be local exchange service provided to the general public, often in competition with wireline local exchange telephone service. The Communications Act contains a clear denial of jurisdiction over intrastate communications for this Commission in Section 2(b) of the Commu-

---

[9] Written Statement of Clifford A. Bean, Arthur D. Little, Inc., dated December 8, 1991 in the Commission's En Banc Proceeding in GEN Dkt No. 90-314.

nications Act. The state commissions have a strong interest in assuring that universal local exchange service remains viable at reasonable prices within their boundaries. Far beyond land mobile services and cellular services developed for use in traveling vehicles, PCS makes possible wireless public switched network telephone service, interconnected with the local exchange network. PCS service has profound implications for LEC service pricing and availability, telephone cost separations, investment incentives and infrastructure development. Thus, both basic comity and respect for intent of Congress preclude preemption of state authority over intrastate PCS provision.

Common carrier classification will also assure that the new PCS "universal" wireless services will be encompassed under federal, state and local requirements upon common carriers to participate in publicly mandated programs to protect safety of life and property. As the advanced versions of established "universal" services, the opportunities for PCS to become an important element in the network of communications systems supporting public safety could turn out to be one of the most valuable attributes of this new technology. Projected public safety uses for PCS-based communications include temporary restoration of fixed services in a natural disaster, emergency communications in event of a threat to life or property, and requests for care in the event of a health emergency. We also note parallel developments in "911" services which are being

greatly enhanced in several states by closely integrating cellular networks into the coverage of these services. The point here is that regulatory authorities have traditionally relied upon common carriers who provide the broadbase of essential communications to participate in federal, state and local public safety efforts. We think that PCS, the future "universal" service, should be included in the mix of common carrier technologies to assure their availability to meet vital public responsibilities.

We support a common carrier classification of PCS also because essential fairness requires that the regulation of PCS providers be neither more onerous nor less restrictive than that imposed upon the established providers of the other common carrier services with which they will compete. In particular new PCS providers such as those from the CATV industry, who have stated that they intend to provide services to compete with regulated common carriers such as LECs should not be given preferential treatment under the Commission's new rules for PCS. This essential parity of regulation will be assured if all PCS providers are classified as common carriers.

(6) The Commission Should Evaluate Proposals For Any PCS Provider To Hold Multiple Licenses For 2 GHz PCS Spectrum In Any Single Service Area On A Case-by-Case Basis.

Rather than set a specific standard, such as a limit of one 2 GHz PCS license per provider per service area or capping the

total of such spectrum any provider might hold, the Commission should evaluate proposed transfers or assignments of PCS licenses on a case-by-case basis. At this early stage of the development of PCS, case-by-case evaluation is appropriate to permit the Commission to develop policies and practices based upon actual competitive conditions and other material considerations which the affected PCS providers and other interested parties will bring to the Commission's attention.

(7) PCS Licenses Should Be Afforded Rights To Interconnect To The Public Switched Telephone Networks Comparable To Those Afforded Existing Services.

We support interconnection of PCS with the public switched telephone network (PSTN) to ensure that PCS customers can connect to locations served by wireline facilities, benefit from cost-efficient reliance on established exchange trunk capacity, and have access to PSTN-provided advanced intelligent network features. The established Commission policies which require appropriate interconnection between common carriers upon reasonable demand should be extended to apply to PCS.

(8) Lottery Selection Procedures Should Be Used To Select Among Competing Applicants For 2 GHz PCS License, Subject To Stringent Requirements To Deter Speculation.

We support use of lottery selection procedures as the most appropriate mechanism for licensing PCS provided effective

measures are taken to deter speculative filings. It has proved to be a rapid, efficient and cost-effective selection method and should be used here.[10]

In order to deter speculation, it is essential that the Commission require all applicants to demonstrate that they are legally and financially qualified. The application required to be filed should be abbreviated as much as possible, but be adequately detailed to disclose at least: (1) ownership of the applicant; (2) interests (direct or indirect, if any) in other competing applications; and (3) a firm financial commitment, provided the commitment exceeds a substantial minimum dollar amount to be determined by the Commission. For example, the Commission might establish a "minimum" based on estimates of the cost to construct a PCS such as $5.00 times the population of the proposed service area.[11]

---

[10] We strongly oppose competitive bidding even if it is authorized by Congress. See also discussion in Wildman Statement regarding the drawbacks and problems with use of auction procedures, Section VI, pp 48-50.

[11] This $5.00 amount is a preliminary estimate of the capital cost to initiate minimum PCS operations. Based on statistics in CTIA News Release dated September 8, 1992, the cumulative capital investment of the cellular industry was approximately $9.3 billion or approximately $18.50 per person per cellular system. Our proposed $5.00 figure substantially understates this amount of investment to establish an appropriate "minimum" threshold for financial qualifications purposes and to allow for variation in capital cost characteristics of diverse PCS system designs.

In general, the Commission's standards for firm financial showings in its cellular and 220-222 MHz Narrowband rules are adequate but should be supplemented to provide expanded options for companies relying upon internal financing. The Commission should also reinstate its policy that its "net current assets" requirement will be satisfied if the ratio of a company's total net assets exceeds, by at least a factor of 14 to 1, the amount of the required firm financial commitment.[12]

We also support adoption of fully compensatory filing fees which reflect the substantial number of separate facilities to be installed in each service area. The Commission should make a reasonable estimate of the number of transmitter locations per service area and using the prescribed fee structure for common carrier base stations calculate the fee to be submitted with each system application.

Pre-lottery settlements should be prohibited in order to diminish speculative incentives to "game" the lottery process. Eliminating such settlements also should avoid the necessity for the Commission staff to spend time processing pre-lottery settle-

---

[12] See, American Cellular Corp., 103 F.C.C.2d 26, 30-31 (1986); Arnold C. Leong, DA 86-197, released November 14, 1986; Johnstown Cellular Communications Co., DA 86-332, released December 16, 1986; Robert L. Kile, DA 87-72, released January 28, 1987; Gary R. Zipper, DA 87-128, released February 26, 1987; Contel Cellular, Inc., DA 87-824, released July 8, 1987.

ment filings. This will promote an orderly and prompt lottery selection process.

In the event a lottery winner is disqualified, the Commission should hold a subsequent lottery among the remaining participants of the original lottery. We oppose the alternative approach of selecting a contingent winner as needlessly promoting litigation and delay.

While we support the strongest possible requirements to deter speculation, we are also realistic enough to know that applicants inevitably will be selected who are either unwilling or unable to construct and operate the PCS systems which they have proposed. In the interest of promoting early deployment of PCS, the applicants should be permitted to transfer their PCS licenses at any time after system construction is authorized. The companies who are prepared promptly to deploy PCS systems should be permitted to acquire licenses at the earliest opportunity. Anti-trafficking requirements have not deterred speculation in the past and should not be adopted here.

In the absence of any anti-trafficking requirements, the Commission should also adopt a five-year "fill-in" requirement comparable to current cellular policies, i.e. Sections 22.3 (a)(i) and 22.31 (f) of the Commission's rules, to preclude "warehousing" of 900 MHz spectrum. Speculators who win PCS

lotteries should not be permitted simply to "sit on" their licenses while they wait for lucrative offers. The possible loss of all or some part of their service area authority should be a strong incentive to transfer sooner rather than later.

(9) The Commission Should Restrict The Service Definition Of PCS As Little As Possible.

We recommend that the service definition be kept flexible so as to avoid unintentionally foreclosing opportunities to develop valuable new applications for PCS technology. The Commission has described PCS simply as a technology to provide a "family" of communications services for "people on the move."[13] We can only guess at this early stage of PCS development whether the public will perceive the most valuable PCS-based services to be voice, data, graphics or some other variation on all of these capabilities and how the public will use these new capabilities. Apart from the specific restriction to preclude PCS use for "broadcasting," we see no reason to limit the ways it can be implemented to serve the public whether at mobile, portable, temporary fixed or fixed customer locations.

[13] PCS NPRM, ¶ 29-30.

CONCLUSIONS

The Commission is addressing in its combined 2 GHz broadband and 900 MHz narrowband PCS allocations major technological advances which will affect the way the public uses telecommunications well beyond this decade. We applaud the aggressive approach which the Commission has taken to resolve potentially highly controversial allocations issues and to create a regulatory environment which promotes innovations in technologies and services. The Commission should now complete these important initiatives by adopting a regulatory structure which encourages robust competition (five licensees per service area), rapid development of the full potential for PCS in "local" service areas (MSA/RSA boundaries) with opportunities for all qualified applicants to hold PCS licenses. LECs and cellular operators should not be excluded. Lottery selection procedures subject to stringent anti-speculation safeguards will hasten deployment. A common carrier regulatory classification will help assure that PCS fulfills its promise as a "universal" public communications resource. Adoption of these recommendations will make possible

the achievement of the universal availability, rapid deployment and diversity of PCS service offerings, i.e. the "values" which the Commission has indicated will guide its decision-making.

Respectfully submitted,

AMERICAN PAGING, INC.

By /s/ George Y. Wheeler
George Y. Wheeler

Koteen & Naftalin
1150 Connecticut Avenue, N. W.
Suite 1000
Washington, D. C. 20036
(202) 467-5700

November 9, 1992

Its Counsel

Economically Efficient Licensing Policies for Personal Communication Services

by

Steven S. Wildman

Associate Professor of Communication Studies
and
Director, Program in Telecommunications
Science, Management, and Policy

Northwestern University

November 9, 1992

Table of Contents

Economically Efficient Licensing Policies for Personal Communication Services

by

Steven S. Wildman*

I. Introduction and Summary

Personal communication services (PCS) represent the potential for dramatic increases in the quality and variety of telecommunications services available in the United States. In its Notice of Proposed Rulemaking (NPRM) of July 16, 1992, the Commission asked for comments on a number of issues, the resolution of which is likely to strongly influence the extent to which the potential benefits of PCS are realized. In these comments I address four of these issues: (1) the size of the service areas to be licensed for PCS services; (2) the number of licenses (3, 4, or 5) to be awarded per service area; (3) the conditions under which local exchange carriers (LECs) may obtain PCS licenses;

---

* Associate Professor of Communication Studies, Director of the Program in Telecommunications Science, Management and Policy, and Academic Affiliate of the Center for Information and Telecommunications Technology, Northwestern University. Previously, economic consultant (1983-1988); Assistant Professor, Department of Economics, UCLA (1979-1983); and consultant to the Rand Corporation (1980-1983). I hold a B.A. in Economics from Wabash College and a M.A. and Ph.D. in Economics from Stanford University.

I have co-authored two books and coedited one book, all on the economics of communication industries, and have authored or co-authored numerous articles in professional journals and edited volumes. Much of this work has focused on economic and policy issues raised by communication industries. My curriculum vitae is attached at the end of this paper.

and (4) whether and under what conditions cellular carriers should be allowed to obtain PCS licenses. I also offer a few brief observations on the merits of lotteries versus auctions as mechanisms for awarding licenses and some desirable rules for lottery filings and post lottery conduct.

My conclusions are that the public's interest in PCS will be best served by licensing relatively small service areas, by awarding five PCS licenses for each service area, and by allowing LECs and cellular operators to participate in PCS under the same terms and conditions that will be applied to all other applicants and licensees. These conclusions are supported by both economic theory and an assessment of relevant empirical evidence.

The analysis of service area size is presented in the next section. There I show that small service areas will facilitate the development of a healthy PCS industry that effectively serves the needs of telecommunications users in several ways. (1) Small service areas, by increasing the number of licensees, will permit a greater degree of experimentation under commercial conditions with alternative approaches to PCS than would be possible if fewer (large) service areas were licensed. The industry should be able to conduct commercial experiments with a large number of approaches to PCS early on because of the danger that network industries (like telecommunications industries) will lock-in on inferior approaches adopted before superior alternatives

are trialed; large user bases make it difficult for carriers and users to switch to superior approaches later on. (2) The network nature of telecommunication industries gives rise to an information (contracting costs) problem that makes it harder to split large areas up to create smaller ones than it is to combine small areas to make large ones. This transaction cost asymmetry means that large areas may not be broken up to allow for the implementation of PCS infrastructure and services that best meet the unique needs of individual communities, even when social welfare would be increased by doing so.

Clustering of contiguous service areas under common ownership is less prevalent in cellular than is apparently presumed in the NPRM, and the clusters that are observed do not correspond to either the MTAs or BTAs that have been proposed as service areas for PCS licenses. Furthermore, there are explanations other than the efficiency argument of the NPRM for why regional clusters have historically developed in the cellular industry--including the geometric necessity that geographical clustering must increase as the industry consolidates.

My analysis in Section III shows that five licenses have definite advantages for promoting experimentation with new technologies and for encouraging the development of a diverse array of PCS services.

Section IV considers the advantages and purported disadvantages of allowing LECs to offer PCS anywhere, including in their LEC service areas. The likelihood of significant economies of scope, the roles of LECs in providing universal service and implementing new telecommunications technologies, and the fact that LEC participation is unlikely to have a deleterious effect on competition among wireless telecommunications services lead to the conclusion that the public's interest in PCS will be best served if LECs are allowed to be full and equal participants in this industry.

I examine the case for cellular operators participating in PCS as holders of licenses to PCS spectrum in their cellular service areas in Section V. As with LECs, there is a strong likelihood of significant economies of scope while the threat to competitive efficiency is minimal.

I consider various policy issues raised by spectrum auctions and lotteries in Section VI. Lotteries have certain advantages over auctions. Restrictions on post-award transfers, or rapid build-out requirements, would be detrimental to the efficient development of PCS.

I summarize my findings and my policy conclusions in Section VII.

II. Small service areas will best serve the Commission's efficiency and competitiveness objectives.

The size of service areas to be licensed for PCS is one of the most important issues to be resolved in this rulemaking. As I show below, service area size has a direct bearing on the speed and efficiency with which the industry identifies services and technologies that satisfy marketplace needs. Service area size also affects the ability of the industry to arrive at a geographic and ownership configuration that allows it to provide its services efficiently.

The Commission specifically requested comments on the merits of the following options: (1) Rand McNally's Basic Trading Areas (BTAs); (2) LATA boundaries; (3) Rand McNally's Major Trading Areas (MTAs); and (4) nationwide licenses. The possibility of a mixed scheme, such as reserving a portion of PCS spectrum for MTA licenses and allocating the rest to BTA licenses, is also suggested. The MSAs and RSAs licensed for cellular service are another widely discussed option, which would produce smaller service areas than the above options.

The NPRM offers two reasons for preferring PCS service areas larger than those licensed for cellular telephone. One is that the combination of the lottery procedures employed and the number of licenses awarded in licensing cellular services was costly and an administrative burden to the

Commission. The second, which is by far the most important, is the possibility that substantial transaction costs associated with reconfiguring the cellular industry after licenses were awarded could be avoided in PCS by licensing larger service areas. My analysis focuses on the economic efficiency implications—including effects on transaction costs—of alternative licensing schemes. The administrative costs associated with awarding PCS licenses will be incurred only once and are bound to be trivial in comparison to the potential ongoing costs of reduced economic efficiency should an inappropriate licensing policy make it more difficult for the market to facilitate carriers' and users' choices among alternative services and technologies or should it stand in the way of the development of efficient geographic and ownership structures for this new industry.

A. Perspectives on Transaction Costs

The transactions cost argument for larger service areas is based on one interpretation of recent trends in the cellular industry. As a consequence of the manner in which cellular wireline licenses were initially awarded and recent consolidation of ownership, regional clusters of service territories under common ownership are now a prominent structural feature in the cellular industry.[1] The Commission suggests that the transactions costs incurred in putting

[1] Later in this section I present evidence showing that most cellular clusters are not of MTA or even BTA size.

together regional clusters for cellular service might be avoided in PCS by licensing larger service areas.

Transaction costs are important and should be taken seriously, but they are just one of a number of factors that must be considered if licensing policy is to be used to promote economic efficiency in the provision of personal communication services. To a large extent, economic efficiency is a reflection of industry structure. In addition to a level of market concentration sufficiently low to encourage vigorous competition,[2] an efficient industry structure for PCS would have the following attributes: (1) the combination of services and technologies that maximizes benefits net of costs to PCS users; (2) ownership of the industry's assets residing in the hands of the firms that can operate them most effectively; and (3) a pattern of geographic concentration that makes it possible to take advantage of potential organizational and technical economies of scale. An industry that exhibits these structural features will provide greater economic benefits than one that does not. Of course, the speed and costs incurred in achieving an efficient industry structure are also important.

The transaction costs argument for larger service areas advanced in the NPRM focuses on the achievement of the third attribute of an efficient industry structure to the exclusion

[2] This question is addressed with respect to PCS in Sections IV and V of this paper.

of the first two. In the analysis presented below I show that small service areas have clear advantages for promoting the achievement of the first two attributes. In addition, a careful examination of both evidence and theoretical considerations suggests that the balance of advantages probably lies with small service areas for the achievement of the third attribute of an efficient industry as well.

B. Facilitating the Evolution of PCS Services and Technologies

PCS policies must address the needs of an industry that has yet to define its services and develop its technologies. Today PCS represents the potential for a yet to be determined family of wireless, portable services with widely varying levels of functionality. In the long run, the market will determine the collection of service offerings and delivery technologies that will constitute PCS. By contrast, the first cellular licenses that were awarded in 1982 were for the provision of a tightly prescribed set of services based on a technology that had been developed over a decade earlier in AT&T's Bell Labs and set forth in rules adopted by the FCC.[3] Competitive forces operate very differently in a market where the selection of services and delivery technologies is still up for grabs than in a market where these issues are already resolved. Therefore, it is

---

[3] Rohlfs, J., Jackson, C., and Kelley, T., "Estimate of the Loss to the United States Caused by the FCC's Delay in Licensing Cellular Telecommunications," National Economic Research Associates, November 8, 1991.

important that PCS licensing policy be developed with the need of a new industry to explore the potentials of embryonic technologies and services in mind. To set the stage for the policy recommendations that follow, I will first briefly discuss the evolutionary dynamics of new industries.

1. The Economics of Industry Evolution

Theory. David Teece,[4] borrowing heavily from earlier work by Abernathy and Utterback,[5] has provided a useful conceptual framework for describing the developmental phases many industries pass through as they progress from their early, uncertain beginnings to a more stable, "mature" phase. During the earliest phases of an industry's development, which Teece calls the preparadigmatic stage, "[c]ompetition among firms manifests itself in competition amongst designs [paradigms], which are markedly different from each other."[6] Eventually, after a period of trial and error, the market settles on one or a few dominant designs that experience has shown to do a better job of meeting user needs.

Once the identity of the dominant design (or designs) becomes apparent, the industry enters its paradigmatic stage, where price competition is more important and winners and losers are selected on the basis of their ability to supply

---

[4] Teece, D., "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," *Research Policy*, 15 (1986), 285-305.

[5] Abernathy, W. J. and Utterback, J.M., "Patterns of Industrial Innovation," *Technology Review*, 80 (1978), 40-47.

[6] Teece, op. cit., p. 288.

products and services incorporating the dominant design reliably and at low cost. Innovation may continue during the paradigmatic stage, but it is likely to be reflected in incremental improvements in products and production processes based on the dominant design, rather than new product innovations that depart radically from accepted standards. The early phases of the paradigmatic stage may be characterized by a "shakeout" period during which less efficient firms exit the industry with their assets often being absorbed by the surviving firms as the industry consolidates. The winners of the efficiency-based competition during the paradigmatic stage will be the major players in the mature industry.

Example of Personal Computers. The history of the personal computer industry illustrates these stages in the evolution of a high tech industry.[7] The first commercial personal computer was MITS' Altair, first marketed as a kit in *Popular Electronics* in early 1975. By the end of 1977 over fifty firms were competing in this industry. Most of these computer ventures failed quickly.

Apple entered the PC industry in 1976 with the Apple I, which sold about 200 units, mostly in the San Francisco Bay

[7] For the most part, this brief review of the history of the personal computer industry draws on the following sources: Freiberger, P. and Swain, M., *Fire in the Valley*, Osborne/McGraw-Hill, Berkeley, 1984; Chposky, J. and Leonsis, T., *Blue Magic: The People, Power, and Politics Behind the IBM Personal Computer*, Facts on File Publications, New York, 1988; and Forester, T., *High-Tech Society*, MIT Press, Cambridge, 1987.

Area. The Apple II, which soon became the industry leader, was introduced in April 1977. By the end of 1981, Apple was fighting with Tandy for the lead in personal computer sales. Other prominent PC brands at this time were Osborne, Atari, Commodore, Hewlett-Packard, Radio Shack, Texas Instruments, Xerox, Zenith, and IBM (a new entrant). About 150 smaller companies made up the rest of the industry. The six short years since the introduction of the Altair had seen the entry of hundreds of different brands of personal computers embodying a wide variety of technologies, features, and approaches to the market.

The introduction in 1981 of IBM's 16 bit personal computer with the MS-DOS operating system marked the beginning of the end of the preparadigmatic stage of the PC industry. MS-DOS soon became the industry standard, with IBM the clear leader in sales.[8] In October 1983 *Business Week*[9] proclaimed IBM the winner of the PC wars.

Competition during the paradigmatic stage of the PC industry has turned on the ability to efficiently manufacture and market machines based on the MS-DOS standard. IBM dominated sales of MS-DOS PCs early on with its market share

---

[8] Apple was the lone, significant holdout maintaining a proprietary operating system, first with the Apple II, followed by the Macintosh line of PCs. As it lost market share to makers of PC clones in the late 1980's, IBM responded by introducing a new operating system, OS/2. While OS/2 has enjoyed modest success, it has done little to end the dominance of MS-DOS machines.

[9] "Personal Computers: And the Winner is IBM," *Business Week*, October 3, 1983, 76-79, 83, 84, 90, 96.

rising to over 50 percent by 1985,[10] but eventually saw the bulk of industry sales captured by manufacturers of "clones," offering reliable MS-DOS machines at substantially lower prices and who even began to advance the capabilities of PCs based on this standard at a faster rate than IBM. Major clone makers such as Compaq and Dell and dozens of smaller brands now account for the bulk of MS-DOS machines.

Implications. From the vantage point of a mature industry, it is tempting to view the often considerable investments in approaches that failed to make the final cut as wasted and unnecessary. But this would be incorrect. When it is not known which approaches are superior in advance, the market process proceeds on the basis of trial and error. The costs of failed experiments represent an unavoidable part of the price that has to be paid to identify those approaches that best meet the needs of the marketplace. This is the only way to find out what works and what doesn't. Furthermore, innovations introduced with failed products often reappear as features of later successes.[11]

In the long run an industry is likely to do a better job of meeting its customers' needs if it is able to choose among a large number of alternative technologies, features,

---

[10] "Small Business Bolsters PC Sales," *MINI-MICRO SYSTEMS*, June 1986, 85, 86, 91, 93.

[11] For example, the first computer to combine the CPU and monitor to form a single unit was a failure that bankrupted IMSAI, the company that introduced it. But this combination was a feature of a number of subsequent PCs that were commercial successes, including the first models of the highly successful Macintosh computer.